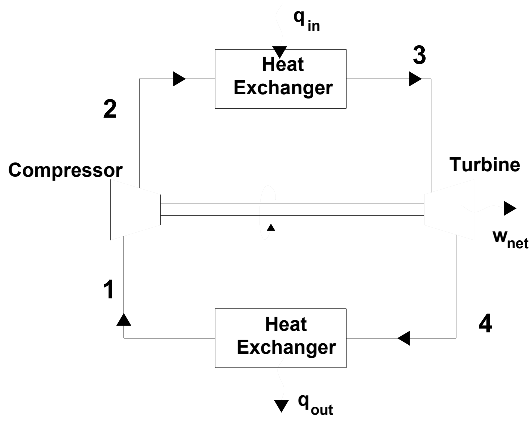
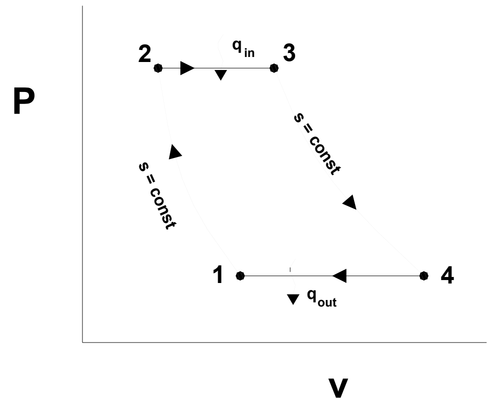
Summary:



Ideal Brayton Cycle Schematic



Ideal Brayton Cycle Process Diagram

Common Assumptions:

1) Air-standard or cold-air standard assumptions are applicable
2) Δke, Δpe ≈ 0
3) Steady operating conditions exist

For Ideal Gases

1) $$h_2 - h_1 = c_p\left(T_2 - T_1\right)$$

2) $$\frac{T_2}{T_1} = \left(\frac{P_2}{P_1}\right)^{\frac{k-1}{k}}$$ (isentropic process only)

Regenerator Effectiveness, ε

$$\varepsilon = \frac{q_{regen,act}}{q_{regen,\max}}$$

Back Work Ratio, r_{wb}

$$r_{bw} = \frac{w_{comp,in}}{w_{turbine,out}}$$

Question:

A regenerative gas turbine with intercooling and reheat operates at steady state. Air enters the compressor at 100 kPa, 300 K with a mass flow rate of 5.807 kg/s. The pressure ratio across the two-stage compressor is 10. The pressure ratio across the two-stage turbine is also 10. The intercooler and reheater each operate at 300 kPa. At the inlets to the turbine stages, the temperature is 1400 K. The temperature at the inlet to the second compressor stage is 300 K. The isentropic efficiency of each compressor and turbine stage is 80%. The regenerator effectiveness is 80%. Determine

a) The thermal efficiency
b) The net power developed (kW)
c) The back work ratio

Step 1: Draw a diagram to represent the system